CLAIMS

What is claimed is:

1. An interconnection element comprising:

a first element material adapted to be coupled to a substrate; and

a second element material coupled to the first element material,

wherein one of the first element material and the second element material comprises a material having a transformable property such that upon transformation, a shape of the interconnection element is modified.

2. The interconnection element of claim 1, wherein the interconnection element is of a size suitable for directly contacting a semiconductor device.

3. The interconnection element of claim 1, wherein a transformation of the one of the first element material and the second element material is irreversible.

4. The interconnection element of claim 1, wherein the transformable property is such that a first volume of the material is adapted to be transformed to a different second volume.

5. The interconnection element of claim 4, wherein the first element material and the second element material are arranged in a configuration such that the second element material overlies the first element material and the first volume of the second element material is greater than the second volume.

6. The interconnection element of claim 4, wherein the first element material is thermally stable and a transformation of the second element material from the first

volume to the second volume is a result of exposing the second element material to heat.

7. The interconnection element of claim 6, wherein the transformation comprises at least about 90 percent of the transformable volume change of the second element material.

8. The interconnection element of claim 1, wherein each of the first element material and the second element material have a transformable property.

9. The interconnection element of claim 1, wherein at least one of the firsts element material and the second element material are introduced by plating.

10. The interconnection element of claim 1, wherein at least one of the first element material and the second element material are introduced by sputtering.

11. The interconnection element of claim 1, wherein at least one of the first element material and the second element material are introduced by electroless plating.

12. The interconnection element of claim 3, wherein the first element material comprises palladium or its alloy.

13. The interconnection element of claim 4, wherein the first element material is an alloy comprising palladium/cobalt and the activation layer comprises one of copper and nickel.

14. The interconnection element of claim 13, wherein the second element material further comprises nickel.

15. The interconnection element of claim 13, wherein the second element material comprises a nickel alloy.

16. The interconnection element of claim 1, wherein the one of the first element material and the second element material comprises a shape memory alloy.

17. The interconnection element of claim 16, wherein the second element material comprises the shape memory alloy and overlies the first element material.

18. The interconnection element of claim 1, wherein the transformable property is a stress and the transformation reduces the magnitude of the stress of the material.

19. The interconnection element of claim 18, wherein the first element material comprises the material having the transformable property and the second element material has a tensile stress, wherein upon transformation, the deformation comprises a response to the tensile stress of the second element material.

20. The interconnection element of claim 19, wherein the second element material is thermally stable and a transformation of the first element material is a result of exposing the first element material to heat.

21. The interconnection element of claim 18, wherein the first element material comprises the material having the transformable property and the second element material has a compressive stress, wherein upon transformation, the deformation comprises a response to the compressive stress of the second element material.

22. An electronic component comprising:

a substrate with a plurality of contact nodes; and

a plurality of free-standing resilient interconnection elements coupled to the substrate in such a manner that a base of an interconnection element electrically contacts a corresponding one of the contact nodes and an interconnection element comprises:

a first element material adapted to be coupled to a substrate, and

a second element material coupled to the first element material,

wherein one of the first element material and the second element material comprises a material having a transformable property such that upon transformation, a shape of the interconnection element is modified.

23. The electronic component of claim 22, further comprising:

a plurality of conductive signal lines associated with the substrate; and

in the plurality of free-standing resilient interconnection elements coupled to the substrate, the base of the interconnection element electrically contacts a corresponding one of the signal lines and an interconnection element.

24. The electronic component of claim 22, wherein a transformation of the one of the first element material and the second element material is irreversible.

25. The electronic component of claim 24, wherein the transformable property is such that a first volume of the second element material is adapted to be transformed to a different second volume.

26. The electronic component of claim 25, wherein a free portion of the interconnection element is initially fixed to the substrate and when the free portion is released from the substrate, the free portion is adapted to be biased away from the substrate in response to a transformation of the second element material from the first volume to the second volume.

27. The electronic component of claim 26, wherein the first element material and the second element material of the interconnection element are arranged in a configuration such that the second element material overlies the first element material and the first volume is greater than the second volume.

28. The electronic component of claim 27, wherein the first element material is thermally stable and a transformation of the second element material from the first volume to the second volume is a result of exposing the second element material to heat.

29. The electronic component of claim 28, wherein the transformation comprises at least 90 percent of a transformable volume change of the second element material.

30. The electronic component of claim 22, wherein each of the first element material and the second element material have a transformable property.

31. The electronic component of claim 22, wherein at least one of the first element material and the second element material are introduced by plating.

32. The electronic component of claim 22, wherein at least one of the first element material and the second element material are introduced by sputtering.

33. The electronic component of claim 22, wherein the first element material comprises palladium.

34. The electronic component of claim 22, wherein the second element material overlies the first element material and each interconnection element further comprises a spring material coupled to the second element material, the spring material comprising at least about 90 percent of the interconnection element.

35. The electronic component of claim 34, wherein the spring material comprises a nickel alloy.

36. The electronic component of claim 34, wherein the interconnection element further comprises a contact material adjacent a surface of the spring material.

37. The electronic component of claim 22, wherein the one of the first element material and the second element material comprises a shape memory alloy.

38. The electronic component of claim 22, wherein the transformable property is a stress and the transformation reduces the magnitude of the stress of the material.

39. The electronic component of claim 38, wherein the first element material comprises the material having the transformable property and the second element material has a tensile stress, wherein upon transformation, the deformation comprises a response to the tensile stress of the second element material.

40. The electronic component of claim 39, wherein the second element material is thermally stable and a transformation of the first element material is a result of exposing the first element material to heat.

41. The electronic component of claim 38, wherein the first element material comprises the material having the transformable property and the second element material has a compressive stress, wherein upon transformation, the deformation comprises a response to the compressive stress of the second element material.

42. The electronic component of claim 22, wherein the plurality of free standing interconnection elements are coupled to more than one surface of the substrate.

43. The electronic component of claim 22, wherein the plurality of nodes comprise a first contact points, the electronic assembly further comprising:

at least one re-distribution line coupled to at least one of the plurality of nodes,

wherein the corresponding at least one interconnection element is coupled to a second contact point different from the first contact point, the second contact point and the first contact point coupled through the at least one re-distribution line.

44. The electronic component of claim 22, wherein the substrate comprises one of a semiconductor, a ceramic, an organic, and a metal material.

45. The electronic component of claim 22, wherein the substrate comprises an interposer.

46. The electronic component of claim 22, wherein the substrate comprises a component of a probe card.

47. The electronic component of claim 22, wherein the substrate comprises a socket for releasably connecting the electronic assembly to an electronic component.

48. An assembly comprising:

a first substrate having a plurality of first contact nodes formed on the first substrate and a plurality of free-standing resilient interconnection elements coupled to the substrate in such a manner that a base of an interconnection element electrically contacts a corresponding one of the first contact nodes; and

a second substrate having a plurality of second contact nodes,

wherein the interconnection element comprises:

a first element material adapted to be coupled to a substrate, and

a second element material coupled to the first element material, and one of the first element material and the second element material comprises a material having a transformable property such that upon transformation, a shape of the interconnection element is modified,

wherein the interconnection element has a portion thereof which is capable of moving to a first position in which the interconnection element is in contact with a second contact node.

49. The assembly of claim 48, wherein the assembly is part of a probe card assembly.

50. The assembly of claim 48, wherein the assembly is part of a wafer-level test assembly.

51. The assembly of claim 48, wherein the second substrate is a circuit board.

52. The assembly of claim 48, wherein the assembly is part of a socket and the second contact nodes comprise external connection points.

53. The assembly of claim 52, further comprising a third substrate of a circuit board having a plurality of third contact nodes,

wherein the external connection are aligned with the third contact nodes to couple the package to the third substrate.

54. The assembly of claim 48, further comprising a stop structure disposed on the first substrate and defining the first position.

55. The assembly of claim 48, wherein a transformation of the one of the first element material and the second element material is irreversible.

56. The assembly of claim 55, wherein the transformable property is such that a first volume of the material is adapted to be transformed to a different second volume.

57. The assembly of claim 56, wherein a free portion of the interconnection element is initially fixed to the first substrate and when the free portion is released from the first substrate, the free portion is adapted to be biased away from the first substrate in response to a transformation of the second element material from the first volume to the second volume.

58. The assembly of claim 57, wherein the first element material and the second element material of the interconnection element are arranged in a configuration such that the second element material overlies the first element material and the first volume is greater than the second volume.

59. The assembly of claim 58, wherein the first element material is thermally stable and a transformation of the

second element material from the first volume to the second volume is a result of exposing the second element material to heat.

60. The assembly of claim 59, wherein the transformation comprises at least 90 percent of a transformable volume change of the second element material.

61. The assembly of claim 48, wherein each of the first element material and the second element material have a transformable property.

62. The assembly element of claim 48, wherein at least one of the first element material and the second element material are introduced by plating.

63. The assembly of claim 48, wherein at least one of the first element material and the second element material are introduced by sputtering.

64. The assembly of claim 48, wherein the first element material comprises palladium.

65. The assembly of claim 48, wherein the second element material overlies the first element material and interconnection element further comprises a spring material coupled to the second element material, the spring material comprising at least about 90 percent of the interconnection element.

66. The assembly of claim 65, wherein the spring material comprises a nickel alloy.

67. The assembly of claim 65, wherein the interconnection element further comprises a contact material adjacent a surface of the spring material.

68. The assembly of claim 48, wherein the one of the first element material and the second element material comprises a shape memory alloy.

69. The assembly of claim 48, wherein the transformable property is a compressive stress and the transformation reduces the compressive stress of the material.

70. The assembly of claim 69, wherein the first element material comprises the material having the transformable property and the second element material has a tensile stress, wherein upon transformation, the deformation comprises a response to the tensile stress of the second element material.

71. The assembly of claim 70, wherein the second element material is thermally stable and a transformation of the first element material is a result of exposing the first element material to heat.

72. The assembly of claim 69, wherein the first element material comprises the material having the transformable property and the second element material has a compressive stress, wherein upon transformation, the deformation comprises a response to the compressive stress of the second element material.

73. The assembly of claim 48, wherein the plurality of free standing interconnection elements are coupled to more than one surface of the substrate.

74. The assembly of claim 48, wherein each of the plurality of first contact nodes on the first substrate terminate at first contact points, the electronic assembly further comprising:

at least one re-distribution line coupled to at least one of the plurality of first contact nodes,

wherein the corresponding at least one interconnection element is coupled to a second contact point different from the first contact point, the second contact point and the first contact point coupled through the at least one re-distribution line.

75. The assembly of claim 48, wherein the first substrate comprises one of a semiconductor, a ceramic, an organic, and a metal material.

76. A system for contacting an electronic device including an assembly comprising:

a first substrate having a plurality of first contact nodes formed on the first substrate and a plurality of free-standing resilient interconnection elements coupled to the substrate in such a manner that a base of an interconnection element electrically contacts a corresponding one of the first contact nodes; and

a second substrate having a plurality of second contact nodes,

wherein the interconnection element comprises:

a first element material adapted to be coupled to a substrate, and

a second element material coupled to the first element material, and one of the first element material and the second element material comprises a material having a transformable property such that upon transformation, a shape of the interconnection element is modified,

wherein the interconnection element has a portion thereof which is capable of moving to a first position in which the interconnection element is in contact with a second contact node.

77. The system of claim 76, wherein the system comprises an integrated circuit test system and the assembly is part of a probe card assembly.

78. The system of claim 76, wherein the system is a substrate mounting system.

79. The system of claim 78, wherein the second substrate is a circuit board.

80. The system of claim 78, wherein the assembly is part of a socket and the second contact nodes comprise external connection points.

81. The system of claim 80, wherein the assembly further comprises a third substrate of a circuit board having a plurality of third contact nodes,

wherein the external connection are aligned with the third contact nodes to couple the package to the third substrate.

82. The system of claim 76, further comprising a stop structure disposed on the first substrate and defining the first position.